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GEOPHYSICS, ASTRONOMY AND SPACE

No. 429

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GEOPHYSICS, ASTRONOMY AND SPACE

No. 429

This serial publication contains abstracts of articles and news items from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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I. ASTRONOMY

Abstracts of Scientific Articles

SPACE PROBE STUDY OF RADIO WAVE FLUCTUATIONS AND TURBULENCE NEAR VENUS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 241, No 3, 1978 pp 555-558

[Article by M. A. Kolosov, O. I. Yakovlev, V. I. Rogal'skiy, A. I. Yefimov, V. M. Razmanov and V. K. Strykov, Institute of Radioengineering and Electronics, "Investigation of Fluctuations of Radio Waves and Turbulence of Circumsolar Plasma in Experiments with Radioprobing Using the 'Venera-10' Vehicle"]

[Abstract] The preliminary results of experiments with radio probing, carried out using the satellite "Venera-10," made clear that in the case of radio communication through circumsolar plasma it is necessary to take into account a strong regularly present effect -- broadening of the spectral line of signals, which in turn gives information on the velocity of the solar wind and plasma turbulence. The probing of circumsolar plasma using the "Venera-10" vehicle was accomplished in April-July 1976 using radio waves at a frequency of 928 MHz. The angular distance between the center of the sun and the vehicle ψ during the time of implementation of the investigations varied from 15° to 0.6° . In the experiments a study was made of fluctuations of amplitude, frequency and change in the energy spectrum of radio waves for different values of the ψ angle. These data were used in determining the characteristics of circumsolar plasma. Investigation of amplitude fluctuations indicated that with angular distances $\psi > 12^\circ$ there are weak fadings with an intensity less than 10%. With a decrease in the distance between the radial line and the sun the intensity of the fadings increases and with $\psi = 5^\circ$ it attains a maximum value (about 50%). With $\psi < 4^\circ$ the fluctuations become saturated and their intensity is virtually not dependent on ψ . The frequency variations were studied in the region $2 \cdot 10^{-3} < F < 0.5$ Hz. It is shown that there is a marked deterioration in radio communication conditions with approach of the radial line to the sun. The velocity of the solar wind for different distances from the center of the sun was determined by two methods. In the first method use was made of the results of measurements of the spectral width with approach of the radial line to the sun and with its increasing distance from the sun. The second method is based on an analysis of the amplitude spectra of unsaturated fluctuations.

[536]

II. METEOROLOGY

Abstracts of Scientific Articles

EVALUATION OF STABILITY OF CLIMATIC SYSTEM

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 14, No 6, 1978 pp 597-606

[Article by I. I. Mokhov and G. S. Golitsyn, Institute of Physics of the Atmosphere, "Variational Evaluation of Stability of Climatic System in Simple Models"]

[Abstract] The authors propose a simple variational approach to evaluation of the stability of solutions of simple climatic models of the Budyko and North types. Functionals are obtained for which the energy balance equations used in these models are the Euler-Lagrange equations for the variational problem. The condition of stability of the solutions is determined by the non-negativity of the second variation of the determined functionals. It is shown that present-day climate and the climate corresponding to an earth completely ice covered are stable, whereas the glacial climate is unstable, as has been demonstrated in earlier studies by other means. It was also found that considering the slight dependence of albedo on temperature there is no spontaneous glaciation of the earth. The cited simple computations of the critical limit of ice can serve as an example of the usefulness of the variational approach in climatic problems. Such an approach is capable of giving integral criteria of stability of the system and indicating ways for the transformation of climate for the purpose of attaining deeper extrema with the variation of parameters fixed for a particular climate.

[512]

III. OCEANOGRAPHY

News

TWENTIETH ANNIVERSARY OF "MIKHAIL LOMONOSOV"

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 14, No 6, 1978 pp 680-682

[Article by G. G. Neuymin]

[Abstract] The 20th anniversary of continuous scientific expeditionary activity of one of the oldest ships of the scientific research fleet of the Soviet Union, the "Mikhail Lomonosov," was marked in September 1977. For a period of more than 10 years it was the largest oceanographic vessel in the world. It has been the flagship of the scientific research fleet of the USSR Academy of Sciences. During these 20 years the "Mikhail Lomonosov" made 32 expeditionary voyages, one of them around the world, with a total distance covered of more than 500,000 nautical miles. During this time it made measurements at more than 2,700 hydrological stations. About 2,000 scientific specialists and engineers took part in this work. The ship was at sea about 3,500 days and visited ports in 33 foreign countries. Most of the voyages (more than 20) were made in the Atlantic Ocean, in its tropical regions. One of the most important results of this work was the discovery of the earlier unknown powerful subsurface equatorial countercurrent which was given the name "Lomonosov Current." The vessel participated in the execution of eight international oceanographic programs. In these 20 years the ship was used in carrying out an enormous volume of scientific research on different branches of physics of the ocean. This has resulted in a considerable change in our concepts concerning the structure and dynamics of waters and the physical, chemical and biological processes transpiring in the ocean. The results of this scientific research are reflected in more than 60 collections of articles, 15 monographs, numerous maps and atlases (the most important of these are listed in a bibliography accompanying the article). The "Mikhail Lomonosov" was the first Soviet research ship to have a shipboard computation center. Despite its age, the vessel is in good shape and is continuing its active work in the ocean.

[512]

Abstracts of Scientific Articles

SPATIAL CHARACTERISTICS OF SEMIDIURNAL INTERNAL WAVES

Moscow OKEANOLOGIYA in Russian Vol 18, No 3, 1978 pp 389-395

[Article by K. D. Sabinin and V. A. Shulepov, Acoustics Institute, "Spatial Characteristics of Semidiurnal Internal Waves in Hydrophysical Polygon-70 in the Atlantic"]

[Abstract] The data used in this article for determining the parameters of semidiurnal internal waves were obtained using a network of buoy stations in Hydrophysical Polygon-70. The authors give an analysis of temperature records at the horizon 200 m and current records at the horizons 50, 100, 200, 300, 400, 500, 600, 1,000 and 1,500 m for the period from 29 May through 8 June 1970. On this basis it was possible to compare data on the horizontal and vertical scales of coherence of tidal currents, indicating a multimode character of the semidiurnal internal waves, observed in the polygon. Estimates of the spatial spectra and stability of the ellipses of tidal currents show that the oscillations are essentially anisotropic and directed to the south-southwest. The spatial spectra and comparison of the observed values of the mean square amplitudes of fluctuations of temperature and currents with the eigenfunctions of different modes reveal some predominance of the third mode over the others also present in the internal tides.

[511]

CORRELATION BETWEEN VARIABILITY OF WIND FIELD AND INTERNAL WAVES

Moscow OKEANOLOGIYA in Russian Vol 18, No 3, 1978 pp 396-405

[Article by A. Yu. Benilov, N. I. Solntseva and B. N. Filyushkin, Institute of Oceanology, "Correlation Between Variability of the Wind Field and Internal Waves"]

[Abstract] This investigation was based on data obtained by specialists of the Institute of Oceanology in the Black Sea. Four sensors for measuring wind velocity fluctuations were installed in the near-water layer of the

atmosphere at the horizons 0.5, 1, 2 and 4 m from the sea surface on a mast. Also attached to this buoy was a string of temperature sensors for simultaneous measurements of temperature fluctuations in the thermocline. The statistical data were analyzed and it was found that the correlation coefficients are quite large (0.6-0.8) and increase with depth, attaining a maximum in the central part of the thermocline. The change in coherence and the frequency phase shift for different horizons indicates the existence of a correlation between the wind field and the field of internal waves. It can be concluded that the lower horizons of the thermocline react to the wind in the region of low frequencies, whereas temperature fluctuations in the upper layer of the thermocline are related for the most part to high-frequency fluctuations of the wind field.

[511]

PROPAGATION OF ADMIXTURE IN SURFACE LAYER OF SEA

Moscow OKEANOLOGIYA in Russian Vol 18, No 3, 1978 pp 423-427

[Article by K. Ivanov and Yu. G. Filippov, Institute of Oceanology and State Oceanographic Institute, "Propagation of a Dynamic Passive Admixture in the Surface Layer of the Sea"]

[Abstract] In the example of the western part of the Black Sea the authors solve the problem of the propagation of a dynamically passive admixture in the surface layer of the sea by the method of wandering particle-markers. The number of markers in a unit square determines the concentration of an admixture in a particular region of the sea. The markers are transported under the influence of currents and turbulent fluctuations. The latter are stipulated by a random velocity vector whose components are described by a normal law. The computations made for different parts of the sea indicate that its behavior is essentially dependent on the position of the source and on the dynamics of waters in the region. Situations dangerous from the point of view of shoreline contamination usually arise when the source is situated closer than 5 km from the shore. With a more seaward position of the sources the admixture is diluted relatively rapidly and is transported by the current, not reaching the shore. Such data can evidently be useful in developing effective means for contending with contamination of the coastal zones of the sea. For making sounder recommendations on this problem there must be additional information on hydrometeorological conditions in the region, on the spatial-temporal variability and information on the turbulent structure of the velocity field in the sea.

[511]

METHOD FOR DETERMINING EFFECTIVE VELOCITIES IN CONTINUOUS SEISMIC PROFILING

Moscow OKEANOLOGIYA in Russian Vol 18, No 3, 1978 pp 550-555

[Article by I. N. Yel'nikov, V. G. Gaynanov and V. A. Struchkov, Southern Division Institute of Oceanology, "Experience in Determining Effective Velocities in Continuous Seismic Profiling Using Two Detection Systems"]

[Abstract] The article describes the method employed and the instrumentation used in continuous seismic profiling with two spaced detection systems for the purpose of determining effective velocities. The investigations were made in the Barents Sea during the 23d voyage of the scientific research vessel "Akademik Kurchatov." The authors demonstrate the technical possibility of determining velocities with an accuracy to 5% for depths of 400-500 m with systems spaced up to 250 m. There are variations in stratum velocities within the limits of a single layer exceeding the accuracy of computations. On the basis of a study of the nature of the wave field the hypothesis is formulated that the variations of stratum velocities are related to a change in the facies makeup of the sedimentary deposits.

[511]

PROCESSING OF GEOPHYSICAL DATA WITH DGU-2 CURVE PLOTTER

Moscow OKEANOLOGIYA in Russian Vol 18, No 3, 1978 pp 542-545

[Article by A. Ye. Suzyumov and M. B. Leybov, "Experience in Routine Processing of Geophysical Information Using the DGU-2 Curve Plotter"]

[Abstract] For the routine processing of geophysical information, on the 23d voyage of the scientific research vessel "Akademik Kurchatov" specialists used a programming complex with output to a DGU-2 curve plotter. This plotter was connected to a "Minsk-2" electronic computer. The computer and plotter were used in combination with an "Atlantika" programming complex. The DGU-2 has a considerable speed and a high resolution (0.2 mm); it is possible to plot curves in three different colors with the lines being either solid, dashed or dotted. The curve can be of an almost unlimited length. The width of the working field is 390 mm. The "Atlantika" programming complex is briefly described. The use of this graphic device made possible a considerable increase in the information content of the collected materials and also made it possible, directly on a voyage, to finalize all the data in the form of a report album. One of the sheets from this data album is shown as an illustration.

[511]

TWO METHODS FOR MEASURING TEMPERATURE GRADIENT IN SEA

Moscow OKEANOLOGIYA in Russian Vol 18, No 3, 1978 pp 546-549

[Article by V. Ye. Prokhorov, Moscow Physical Engineering Institute, "Analysis of Two Methods for Measuring the Temperature Gradient in the Sea"]

[Abstract] A knowledge of the vertical distribution of the density gradient $d\rho/dz$ is necessary for many computations. In turn the density gradient can be computed on the basis of measurements of temperature dT/dz and salinity dS/dz . In most cases the measuring instrument is a probe, but this convenient instrument is a source of errors distorting the true profiles of temperature and salinity. This paper gives a comparative analysis of the errors arising in the measurement of the temperature gradient by a freely falling instrument: a) by the method of differentiation of the temperature profile with depth z ; b) by the method of measuring the temperature difference along a base. The temperature profile is idealized in the sense that it consists of steps with an identical temperature differential. The comparison of the two methods presented here indicates that measurement of the gradient by the temperature difference method is preferable.

[511]

PROPAGATION OF PASSIVE ADMIXTURE FROM INSTANTANEOUS POINT SOURCE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 14, No 6, 1978 pp 621-627

[Article by B. A. Kagan, L. A. Oganesyan and V. A. Ryabchenko, Institute of Oceanology and Institute of Socioeconomic Problems, "Propagation of a Passive Admixture from an Instantaneous Point Source in the World Ocean (Numerical Experiment)"]

[Abstract] Within the framework of a baroclinic model of integral circulation, the authors examine the process of propagation of a volumetric concentration of Sr⁹⁰ from an instantaneous point source in the world ocean. The model considered is used in reproducing only the most general patterns of the spatial and temporal distribution of the radioactive Sr⁹⁰ entering into the ocean as a result of a hypothetical underwater nuclear explosion and clarification of the paths for its transport in the world ocean. Taking into account the nature of the problem and the global dimensions of the investigated region, the discussion is limited to a description of the process of propagation of an admixture within the framework of a two-dimensional approximation. The equation of turbulent diffusion, integrated vertically, by means of which this process is described, is solved numerically. A procedure is used which makes it possible to replace the instantaneous point source by a distributed source. The distribution of Sr⁹⁰ with time is illustrated by a map of isochronal lines of a stipulated volume concentration.

[512]

HELICOPTER MEASUREMENTS OF SUSPENSIONS AND CHLOROPHYLL IN SEA

Moscow OKEANOLOGIYA in Russian Vol 18, No 3, 1978 pp 428-434

[Article by V. N. Pelevin, Institute of Oceanology, "Estimate of the Concentrations of Suspension and Chlorophyll in the Sea from the Spectrum of Outgoing Radiation Measured from a Helicopter"]

[Abstract] In 1976 measurements of the brightness coefficient of the sea were made from a helicopter in the Baltic Sea, in the Black Sea and in the waters of the Sea of Azov in Kerch Strait and also over a lake in Crimea. In addition, measurements were made from a steep shore near Karadag. Photometric observations of the sea surface were accompanied by the taking of water samples with a subsequent analysis of the concentration of suspension, pigments of phytoplankton and the light-absorbing fraction of organic matter dissolved in the water. Photometric observations were made at the nadir or at small angles to the vertical. The contribution of mirror reflection of skylight reflected by the water-air discontinuity was subtracted from the observed brightness of the sea surface. On this basis it was possible to develop methods for estimating the content of chlorophyll and the concentration of suspended matter in sea water from the spectra of outgoing radiation.

[511]

ANALYSIS OF MAGNETIC ANOMALIES REGISTERED AT SEA

Moscow OKEANOLOGIYA in Russian Vol 18, No 3, 1978 pp 484-488

[Article by M. B. Leybov and Ye. G. Mirlin, Moscow State University and Institute of Oceanology, "Statistical Analysis of Magnetic Anomalies Registered in Abyssal Magnetic Surveys"]

[Abstract] Six long profiles from an abyssal magnetic survey were used in making an analysis of the spectral characteristics of magnetic anomalies in the Pacific Ocean. It was found that in the spectrum of anomalies registered near the bottom on the axis of the East Pacific Ocean Rise there is a dominance of the high-frequency component, which is appreciable on the profiles situated on its slopes. The spectrum of anomalies, computed from relief, is virtually constant for all profiles. The conclusion is drawn that bottom relief exerts a considerably greater influence on the structure of anomalies in the axial parts of the rise than on its slopes. This can be attributed to the process of low-temperature oxidation of titanomagnetites in oceanic basalts with their increasing distance from the axis of the rise in the spreading process.

[511]

SPECTRAL CHARACTERISTICS OF RADIOEMISSION OF FOAM FORMATIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 14, No 6, 1978 pp 656-663

[Article by G. S. Bordonskiy, I. B. Vasil'kova, V. M. Veselov, N. N. Vorsin,
Yu. A. Militskiy, V. G. Mirovskiy, V. V. Nikitin, V. Yu. Rayzer, Yu. B. Khap-
in, Ye. A. Sharkov and V. S. Etkin, Space Research Institute and Moscow State
Pedagogical Institute, "Spectral Characteristics of Radioemission of Foam
Formations"]

[Abstract] The paper gives the results of investigations of the spectral characteristics of the thermal radioemission of different types of foam formations using highly sensitive radiometric systems in the range $\lambda = 0.2, 0.8, 2, 8$ and 18 cm . It is shown that the concept of foam formations as a "matching layer" cannot completely explain the observed radiobrightness temperatures in the mentioned frequency range. The authors fully describe the methods used and the results of the radiometric measurements, followed by a discussion of electrodynamic models and a comparison with experimental data. Specifically, it is shown that "matching models" of foam formations can explain only 30-60% of the observed radioemission increment. The best correspondence between experimental and computed data is attained in the short-wave part of the millimeter range where the influence of the structural peculiarities of the foam on radioemission is insignificant. Evidently, the important factors in the formation of radio emission of foam formations are others, including diffraction effects on their structural inhomogeneities.

[512]

IV. TERRESTRIAL GEOPHYSICS

News

EARTHQUAKE PREDICTION AIDED BY SPACE PHOTOGRAPHY

Moscow KRASNAYA ZVEZDA in Russian 2 Aug 78 p 3

[Article by V. Tyurin]

[Summary] A group of specialists at the Institute of Geological Sciences Armenian Academy of Sciences was assigned the task of finding a method for using space photographs for the compilation of seismotectonic maps. Candidate of Geological-Mineralogical Sciences R. Arakelyan, Chief of the Tectonics Division, stated that their work involved ascertaining the correlation between faults, linear and annular structures, on the one hand, and seismicity, using space photographs as the raw data. The investigations were based on photographs of the southern, most seismic regions of the country -- Crimea, Caucasus, Central Asia. In analyzing them scientists saw linear and annular structures in a new light. Since the scientists were interested primarily in seismicity and its correlation with landscape elements, they sought combinations characteristic for those places where earthquakes had occurred. They found on the space photographs that definite combinations on space photographs precisely indicated the location of epicenters of well-known earthquakes. But such combinations were also observed in places where there has been no earthquakes. Scientists postulated that earthquakes had either occurred there long ago or that they would occur in the future in these places. The latter possibility suggests that some earthquakes can be predicted. It was possible to construct a map of the localization of epicenters of earthquakes -- known and postulated. The next question was whether the photographs bear some evidence that seismic events at a particular place would be repeated. It can be postulated that on the photographs, at the epicentral points, there is a reflection of the focal energy of the earthquakes, that is, stressing of crustal rocks in the focal zone. Since between the energy of an earthquake and focal depth there is a definite mathematical dependence, by knowing one of the parameters it is also possible to determine the other. The problem now is to use mathematical modeling to find a method for a quantitative estimate of focal energy, a determination of the depth at

which it is situated. If this can be done on a practical basis, a close approach can be made to the problem of earthquake prediction. Knowing the rate of deformation, location of epicenters and the focal stresses, it is possible to prepare a map of seismogenic structures, that is, those places where earthquakes can be expected. Then a series of successive photographs of these places will show how the stresses change. But such studies are of value for other purposes than earthquake prediction alone. A statistical analysis of the epicenters detected on the photographs, known and postulated, will make it possible to establish the pattern of their distribution in the earth's crust. And a knowledge of this circumstance is suitable not only for seismic forecasting, but also for tectonics, for an understanding of the life of the planet as a whole, and for finding useful minerals.

[534]

Abstracts of Scientific Articles

INVERSION OF REFRACTED WAVE TRAVEL TIME CURVE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 241, No 4, 1978 pp 793-796

[Article by V. S. Geyko, Geophysical Institute, Ukrainian Academy of Sciences, "Inversion of Refracted Wave Travel Time Curve"]

[Abstract] The ambiguity in determining the dependence of the velocity of propagation of a seismic wave on depth from the travel time curve of a refracted wave has been investigated in a series of studies (M. L. Gerver, et al., DAN, Vol 163, No 6, 1965; VYCHISLITEL'NAYA SEYSMOLOGIYA, No 3, 1967; Ibid., No 4, 1968). Continuing his work on this subject (see DAN, Vol 218, No 1, 1974), the author has now demonstrated that with some additional assumptions concerning the properties of the depth-velocity function, sufficiently general from the physical point of view, this nonuniqueness is substantially reduced and following the procedures outlined in this paper, on the basis of the travel time curve it is possible to make an unambiguous determination of velocity outside the waveguide and ascertain the precise upper and lower velocity limits in each waveguide.

[537]

METHOD FOR DETERMINING SOURCES OF GEOID UNDULATIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 241, No 4, 1978 pp 789-792

[Article by L. P. Vinnik, A. A. Lukk, M. Mirzokurbanov, Yu. A. Tarakanov and T. N. Cherevko, Institute of Physics of the Earth, "Sources of Very Large Undulations of the Geoid According to Seismic and Gravitational Data"]

[Abstract] The nature of major geopotential anomalies is one of the difficult problems of terrestrial physics. In this paper the authors use a new approach in solving the inverse problem for the gravity field (Yu. A. Tarakanov, et al., DAN, Vol 240, No 1, 1978) with new seismic data obtained using large seismic groups. The most complete analysis was made for the Indian Ocean anomaly, the largest on the earth. Seismic data for the mantle block corresponding to the Indian Ocean anomaly were obtained by the Kirgiz

and Pamir groups of stations. The data used were obtained along a profile running near the center of the Indian Ocean anomaly. It is concluded that in an earth in isostatic equilibrium any anomalous mass present at some depth must be compensated by a mass of the opposite sign which is at some depth in the same column of rock. Anomalous masses of opposite sign, situated in regions of the largest anomalies of the geoid, only partially compensate one another and this causes the gravity anomalies observed at the surface. The data presented in the paper indicate that the upper mantle and the upper part of the transitional zone (400-650 km) virtually do not participate in the formation of these anomalies. It is postulated that the reason for the observed distribution of anomalous masses is the greater viscosity of the bottom of the transitional zone and the lower mantle and therefore the once-impaired equilibrium persists over a long period of time.

[537]

TECTONICS OF EARTH IN LIGHT OF COMPARATIVE PLANETOLOGY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 241, No 4, 1978 pp 903-905

[Article by Corresponding Member USSR Academy of Sciences Yu. M. Pushcharovskiy, Geological Institute USSR Academy of Sciences, "Problems in the Tectonics of the Earth in the Light of Comparative Planetology"]

[Abstract] One of the principal peculiarities of the Pacific Ocean segment is a granite-metamorphic layer over an area which exceeds the total area of the Atlantic and Indian Oceans. Another peculiarity is the extremely high tectonic, magmatic and seismic activity of the broad zone surrounding the ocean floor. There are peculiarities of a formation and metallogenetic nature. It is concluded that the Pacific Ocean zone is very ancient, at least a Precambrian structural formation. The Pacific Ocean has a still more ancient age and it probably reflects the primary inhomogeneity in the earth's structure. The primordial asymmetry of the planet is also indicated indirectly by the discovery of a structural asymmetry on the moon, with a predominance of maria on the visible side of the moon. Recently a structural asymmetry has been observed on Mars and Mercury. In comparison with the earth, the development of the moon and Mercury corresponds to the earth's earliest stage. Observations of the different planets indicate that structural asymmetry is a property which is very stable with time. Since the motion of continental blocks occurs in one half of the planet and does not affect the other, the conclusion is inevitable that there is a barrier to this motion and this barrier is the crust and mantle of the Pacific Ocean. It is therefore only natural to expect complex geodynamic processes along the periphery of the Pacific Ocean, as is in fact observed. And over the course of 1.5 billion years (and even now) there have been and are complex processes of creation of the earth's crust and its destruction in this zone. It can be concluded that tectonic asymmetry must be a common pattern in the structure of planets of the earth group.

[537]

MECHANISM OF FORMATION OF ECHELON FAULTS AND DISLOCATIONS

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 4, 1978 pp 31-37

[Article by A. L. Chernykh, Primorskoye Geological Administration, "Geology and Mechanism of Formation of Echelon Faults and Dislocations"]

[Abstract] The article describes the morphological types of echelon faults, the geological conditions and mechanism of their formation. The results of modeling of some types of echelon faults and dislocations are presented. A series of diagrams illustrate variants of such formations. The review shows that these features are observed under different geological conditions, but the mechanism of their formation, regardless of magnitude, is evidently identical and is related to deformations of the "simple shear" type. The actual nature of the features is influenced by the character of the rocks, the width of the deformation zone and plastic deformations after the formation of fissures. Additional factors can exert an influence on the form of large echelon faults. A knowledge of the laws of formation of echelon faults of different morphological types will make possible a more purposeful search for hidden ore bodies.

[530]

FORMULAS FOR AMPLITUDES OF DIFFRACTED WAVES

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 3, 1978 pp 123-139

[Article by K. D. Klem-Musatov, Institute of Geology and Geophysics Siberian Department USSR Academy of Sciences, "Formulas for Amplitudes of Diffracted Waves"]

[Abstract] In earlier studies (DAN SSSR, Vol 223, No 2, 1975; GEOL. I GEOFIZ., No 10, 1976) the author proposed a method for an approximate mathematical description of diffracted seismic waves in the neighborhood of the boundaries of the geometric shadow. In some cases it is of interest to study these waves in zones of the deep shadow where the mentioned approximation is known to be unsuitable. This paper gives formulas for the amplitudes of diffracted waves simultaneously correct both in the neighborhood of the boundaries of the geometrical shadow and in zones of deep shadow. The idea of obtaining such a description is based on a combining of formulas from boundary layer theory and formulas from the geometrical diffraction theory. A shortcoming of the geometrical theory is that it does not describe the field of a diffracted wave in the neighborhood of the boundaries of the geometrical shadow -- the boundary layers. In this study the author uses as a standard problem the problem of diffraction of a plane wave in a system of sectoral media, making it possible to obtain an explicit description of diffracted waves within the framework of the geometrical theory. By comparing this description with boundary layer formulas, the author derives a more general formula incorporating both concepts.

[529]

STRUCTURE AND CORRELATION OF YUDOMSKAYA SERIES OF KYLLAKHSKOYE UPLIFT

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 3, 1978 pp 19-28

[Article by A. V. Mezentsev, A. P. Nesenenko, V. I. Sukhorukov and V. A. Yan-Zhin-Shin, Yakutsk Geological Administration, "New Data on the Structure and Correlation of the Yudomskaya Series of the Kyllakhskoye Uplift"]

[Abstract] The article describes the detailed cross sections of the Yudomskaya series in a stratotypical locality. Observations along four profiles are discussed. Five large figures show series of sections in different parts of the series. The author has established regional unconformities within the series and at the base of the Pestrotsvetnaya suite of the Lower Cambrian. The series is divided into the Yukandinskaya and Sardaninskaya suites, which are correlated with deposits of the same age on the northern slope of the Aldanskiy Platform. Data are given on the levels of stratomorphic lead-zinc mineralization. In the described region the Yudomskaya series has a clearly expressed two-level structure reflecting the periodicity of tectonic movements during formation of the complex. As a result of inversion of tectonic movements there was first a predominate uprising of the southwestern part of the region and later of the northeastern region. A correlation of the cross sections is given.

[529]

MEASUREMENT OF GRAVITY WITH BALLISTIC GRAVIMETER

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 3, 1978 pp 108-111

[Article by G. P. Arnautov, Ye. N. Kalish, V. P. Koronkevich, A. I. Lohmatov and Yu. F. Stus', Institute of Automation and Electrometry Siberian Department USSR Academy of Sciences, "Ensuring a High Accuracy in Measuring Absolute Gravity Using a Portable Ballistic Gravimeter"]

[Abstract] With adherence to the rules for transport and operation of a laser and rubidium frequency standard it can be assumed that in essence there are no restrictions on measurement of the acceleration of gravity with an accuracy to the first units of the ninth decimal place. However, the possibility of achieving such a measurement accuracy is limited by the error in the electronic registry system. There is a distortion of the stipulated time (or path) interval which can vary with movements from place to place and with changes in temperature and humidity. For measuring and checking the error introduced into the results of determinations of acceleration the authors propose use of a combination of the results of measurements using two different schemes: successive and parallel readings of the path and time intervals for free falling of a body. A system of equations is derived which make it possible to determine the acceleration which is not dependent on the error introduced by the electronic registry system. The method precludes any necessity for using unique measuring devices for determining and checking this error.

[529]

STRUCTURE AND COMPOSITION OF POLYMETAL SUITES

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 3, 1978 pp 29-34

[Article by B. S. Nevolin and S. V. Potapov, All-Union Combine "Aerogeologiya," "Structure and Composition of Pestrotsvetnaya, Dzhabatymskaya and Ust'kirbinskaya Suites in the Uchuro-Mayskiy Region"]

[Abstract] The Lower Cambrian deposits of the eastern margin of the Siberian Platform are attracting increasing attention due to the possibility of finding stratiform deposits of polymetals in them. The article gives detailed descriptions of the Pestrotsvetnaya, Dzhabatymskaya and Ust'kirbinskaya suites found in this region. (However, the latter two suites have been combined into the Iotkanskaya series.) The authors give a series of cross sections for these suites and these serve as the basis for the discussion in the text.

[529]

NONGRANITIC PEGMATITES IN ALTAY-SAYAN REGION

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 3, 1978 pp 63-72

[Article by P. P. Kuznetsov and V. A. Simonov, Institute of Geology and Geophysics Siberian Department USSR Academy of Sciences, "Structural Position of Nongranitic Pegmatites in Sections of Gabbro-Hyperbasite Complexes in the Altay-Sayan Region"]

[Abstract] The characteristics of the structural position of bodies of nongranitic pegmatites in sections of a series of gabbro-hyperbasite complexes in the Kuznetskiy Alatau, Western Sayan and Tuva are given. An attempt is made to classify bodies of nongranitic pegmatites on the basis of a complex of petrographic criteria and association with the formations surrounding them. Conclusions are drawn concerning the relationships between zone morphology, enclosing bodies of nongranitic pegmatites and tectonic environment. On the basis of their position within the ophiolitic complex the pegmatites can be classified as follows: a) pegmatites situated within the hyperbasite part of the section (dunite- and pyroxenite-pegmatites and less frequently gabbro-pegmatites); b) pegmatites associated with the contact zone between the hyperbasites and gabbros (pyroxenite- and gabbro-pegmatites); c) pegmatites associated with the gabbroid part of the complex (and in part with amphibolites) -- gabbro-pegmatites. A table was compiled in which the considered types of nongranitic pegmatites are tied in to a cross-sectional column of the ophiolitic complex. The range of localization of nongranitic pegmatites (except for dunite-pegmatites) is rather narrow. They nowhere rise upward in the section beyond the limits of the zone of development of gabbros and gabbro-pegmatites.

[529]

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

BIOGRAPHIES OF "SOYUZ-31" COSMONAUTS

Moscow PRAVDA in Russian 27 Aug 78 p 1

[TASS Report: "Pages of Biography"]

[Summary] "Soyuz-31" flight commander is 44-year-old Pilot-Cosmonaut Colonel Valeriy Fedorovich Bykovskiy. Since 1955 he has served in the Soviet Army and in 1960 he joined the ranks of cosmonaut candidates. This flight on board "Soyuz-31" is Bykovskiy's third: his previous flights were in June 1963 on "Vostok-5" and in September 1976 on "Soyuz-22."

The "Soyuz-31" research cosmonaut, 41-year-old Sigmund Jaehn, is a citizen of the GDR. A Lieutenant Colonel in the GDR Army Air Force, he was selected for cosmonaut training under the Soviet Union's "Interkosmos" program in 1976. This "Salyut"--"Soyuz" mission is his first orbital flight. [5]

[538]

CHRONOLOGY OF "SALYUT-6" MISSION 5 AUGUST -- 24 AUGUST 1978

[Editorial Report] Moscow PRAVDA in Russian, dated 8 Aug 78 through 25 Aug 78, TASS provides the following information on flight activities on board the manned "Salyut-6" orbital station.

5-6 AUGUST

A flight trajectory correction was made on 5 August, putting the "Salyut-6" -- "Soyuz-29" space complex into an orbit with the following parameters:

- apogee, 359 kilometers;
- perigee, 328 kilometers;
- period of revolution, 91.3 minutes;
- orbital inclination, 51.6 degrees.

In accordance with the program for the processing of materials in space, cosmonauts Kovalenok and Ivanchenkov completed another in the series of experiments in the "Kristall" chamber, attempting to obtain an indium antimonide semiconductor crystal. (PRAVDA 8 Aug 78 p 1)

7 AUGUST

Cosmonauts Kovalenok and Ivanchenkov checked a number of on-board systems, making repairs where necessary and preparing scientific equipment for upcoming studies.

Flight engineer Ivanchenkov began an examination of his heart's biological activity; electrocardiograms were recorded continuously for an entire day by the portable monitor. (PRAVDA 8 Aug 78 p 1)

8 AUGUST

"PROGRESS-3" LAUNCHED

At 1031 hours Moscow time the automatic freight transport ship "Progress-3" was launched from the Soviet Union. It was inserted into an orbit with the following parameters:

- apogee, 249 kilometers;
- perigee, 195 kilometers;
- period of revolution, 88.7 minutes;
- orbital inclination, 51.6 degrees. (PRAVDA 9 Aug 78 p 1)

9 AUGUST

A series of flight trajectory corrections put "Progress-3" into an orbit with the following parameters:

- apogee, 262 kilometers;
- perigee, 244 kilometers;
- period of revolution, 89.4 minutes;
- orbital inclination, 51.6 degrees.

9 August marked the 54th day on board the "Salyut-6" station for cosmonauts Kovalenok and Ivanchenkov. Throughout the day they worked with flight documentation, tested various systems of the complex, exercised on the bicycle ergometer and the treadmill and conducted visual observations of the earth's surface. They also conducted biological experiments to study the development of plants under spaceflight conditions.

Parameters of the microclimate maintained within the station were:

- temperature, 20 degrees Centigrade;
- pressure, 800 mm Hg. (PRAVDA 10 Aug 78 p 1)

10 AUGUST

At 0300 hours Moscow time "Progress-3" docked with the "Salyut-6" -- "Soyuz-29" space complex. The mutual search, approach and docking were conducted automatically with the help of various radiotechnical and computing systems and approach, correction and orientation engines. The "Soyuz-29" crew monitored the docking procedure. (PRAVDA 11 Aug 78 p 1)

11 AUGUST

Cosmonauts Kovalenok and Ivanchenkov conducted operations to shut down all thrusters, putting the space complex into a gravity gradient, in order to facilitate materials processing in the "Splav" and "Kristall" chambers. In "Splav" they conducted experiments to obtain semiconductor materials, including a single crystal of tin-lead tellurium, cadmium and zinc sulfides and selenides and an aluminum and bismuth alloy from the vapor phase. They also worked to obtain crystals of cadmium selenides and gallium arsenides in "Kristall." (PRAVDA 12 Aug 78 p 1)

12-14 AUGUST

For several days cosmonauts Kovalenok and Ivanchenkov were engaged in materials processing in "Kristall" in order to obtain crystals of cadmium selenide, gallium arsenide and indium antimonide. They also conducted operations to unload the "Progress-3" freight transport ship and to dismantle equipment to be replaced on the station. (PRAVDA 15 Aug 78 p 1)

15 AUGUST

16 AUGUST

16 August marked the beginning of the third month in orbit for cosmonauts Kovalenok and Ivanchenkov.

The greater part of the day was devoted to medical studies intended to determine and predict the condition and working capacity of the cosmonauts. Using the "Polinom-2M," "Reograf," and "Beta" instruments, the crew conducted a comprehensive examination of the contractions of the heart and of the effect of various stress loads on blood circulation.

Also included in the day's flight program were a study of the atmosphere within the orbital complex and further materials processing experiments. (PRAVDA 17 Aug 78 p 1)

17 AUGUST

Using the "Progress-3" propulsion system, a flight trajectory correction was made on 17 August which put the "Salyut-6"--"Soyuz-29"--"Progress-3" space complex into an orbit with the following parameters:

-- apogee, 359 kilometers;
-- perigee, 343 kilometers;
-- period of revolution, 91.4 minutes;
-- orbital inclination, 51.6 degrees. (PRAVDA 19 Aug 78 p 1)

18 AUGUST

The "Soyuz-29" crew completed operations to transfer used equipment from "Salyut-6" to "Progress-3" and made observations of the earth's surface.

According to medical data, the pulse rate of commander Kovalenok was 68/minute, of engineer Ivanchenkov -- 62/minute; their blood pressures were 125/60 and 130/60 respectively. (PRAVDA 19 Aug 78 p 1)

19-20 AUGUST

21 AUGUST

"Progress-3" undocked from the "Salyut-6" -- "Soyuz-29" complex after its 12-day joint flight. It was put into an automatic flight mode and then underwent further tests of its on-board systems while still in flight. (PRAVDA 22 Aug 78 p 1)

22-23 AUGUST

24 AUGUST

The "Progress-3" freight transport ship burned up in the dense layers of the atmosphere over the Pacific Ocean.

Cosmonauts Kovalenok and Ivanchenkov continued to work on board the "Salyut-6" station, conducting visual observations and photographing the earth's surface. (PRAVDA 25 Aug 78 p 1)

All of the TASS reports indicate that the cosmonauts were well and that all on-board systems of the spacecraft were functioning normally. [5] [539]

GERMAN PRESS REPORTS ON "SOYUZ"--"SALYUT" REDOCKING MANEUVER

East Berlin NEUES DEUTSCHLAND in German 30 Aug 78 p 4; East Berlin DER MORGEN in German 30 Aug 78 p 1; Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 31 Aug 78 p 6

[Editorial Report] Newspapers in both the FRG and the GDR have reported on what was then the impending "Salyut"--"Soyuz" redocking maneuver. According to the German sources, the undocking of the "Soyuz-31" transport ship from the aft end and its redocking to the forward end of the "Salyut-6" station

represented an effort to free the docking unit located on the equipment bay for the subsequent rendezvous of another "Progress" vehicle. Such a maneuver — a "space first" -- would allegedly span 3-5 days (including all preparations) and require great precision in orbital corrections and in the approach and docking procedures. [5]
[541]

BLAGOV REPORTS ON "SALYUT"- "SOYUZ" REDOCKING MANEUVER

East Berlin ADN INTERNATIONAL SERVICE in German 1427 GMT 30 Aug 78

[Text] Moscow. Details of the planned redocking maneuver of the "Soyuz-31" spacecraft from the aft to the forward end of "Salyut-6" were explained to GDR correspondents on Wednesday by the Acting Flight Director Viktor Blagov at the Flight Control Center near Moscow. The operation, which will be the first of its kind in the history of spaceflight, will take place about 3 to 4 days after Valeriy Bykovskiy and Sigmund Jaehn land in "Soyuz-29."

In order to do so, the "Salyut-6" crew -- Vladimir Kovalenok and Aleksandr Ivanchenkov -- will first of all partially isolate "Salyut-6" over 2 days and then enter "Soyuz-31." The undocking of "Soyuz-31" from "Salyut-6" will then take place, and the "Soyuz-31" craft will then follow "Salyut-6" at a distance of between 100 and 200 meters.

Blagov then continued that "Salyut-6" will then make "half a somersault forward" and will thus face "Soyuz-31" with its forward end. This will be followed by the orientation of the two craft and the automatic approach through commands from the ground control. After docking Kovalenok will return to "Salyut-6." The entire procedure will take about 90 minutes and take place within one earth orbit.

Blagov stressed that the "redocking" could have taken place sooner, but there had been no need for it. Now, however, it is considered necessary, as the aft docking unit of "Salyut-6" must be prepared for the next "Progress" transport ship because only the rear of the "Soyuz-6" craft to "Salyut-6." [sic: as received] Therefore, the planned redocking "is not a test, but necessary for further work," said Blagov.

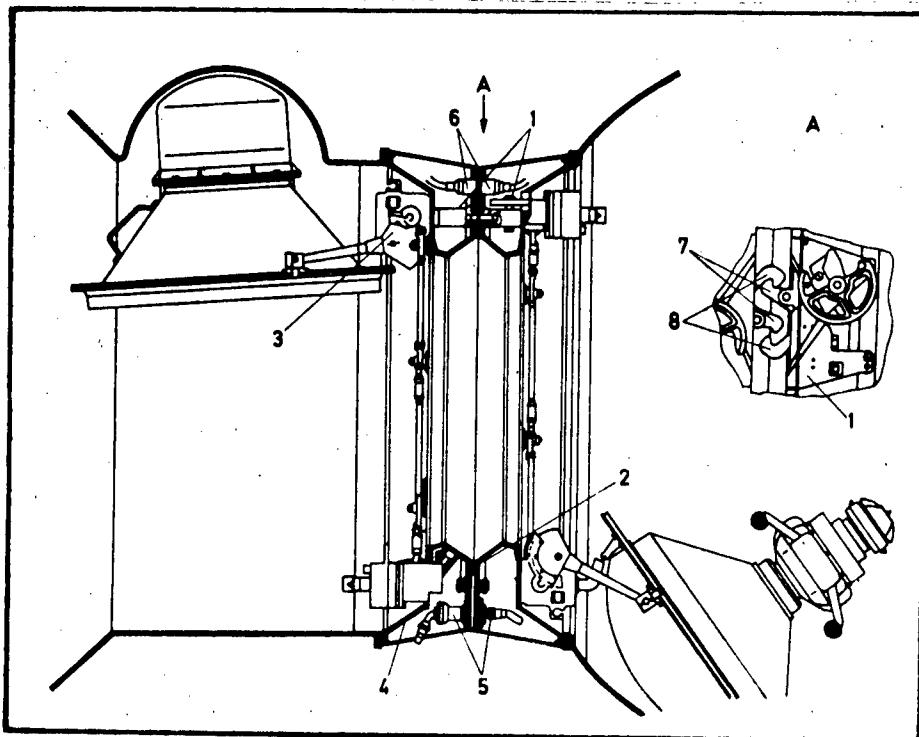
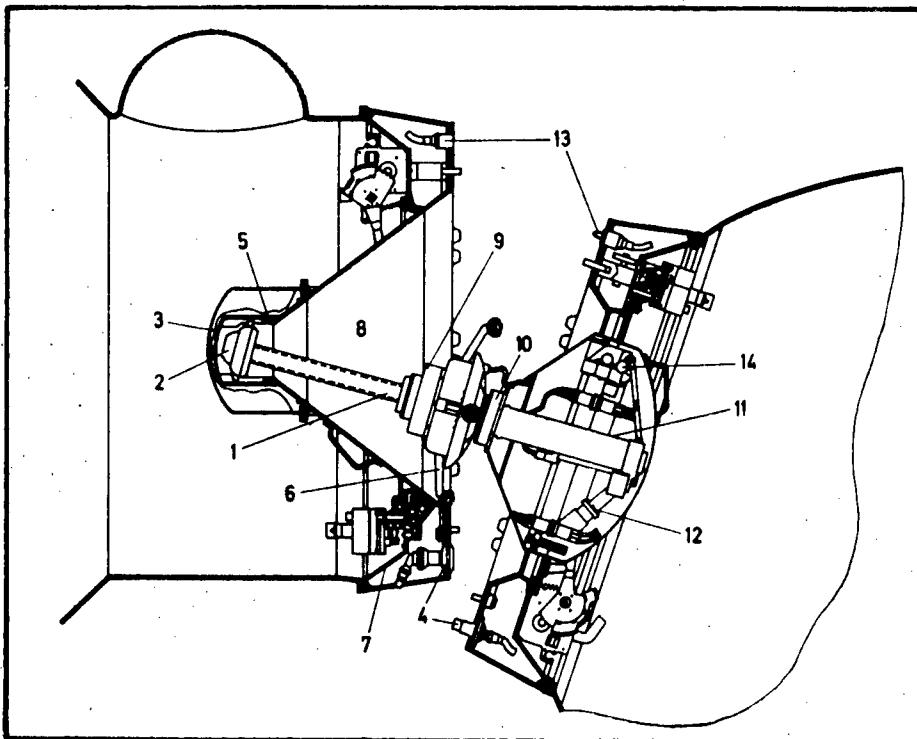
Future space stations would have three, four and perhaps five docking units, of which, however, only two would have the necessary equipment for automatic link-up. The other units could, for instance, be used for the docking of scientific modules.

[542]

"SALYUT"--"SOYUZ" DOCKING MECHANISM

East Berlin FLIEGER-REVUE in German No 8, August 78 p 331

[Diagram of "Salyut"--"Soyuz" docking mechanism from THE SALYUT SPACE STATION]



Above: Docking mechanisms of the "SALYUT" orbital station and the "SOYUZ" transport ship at the beginning of the docking procedure:

- 1 -- extensible probe
- 2 -- expanding head of the active docking mechanism
- 3 -- receiver for the active docking mechanism
- 4 -- connecting plug for the hydraulic system
- 5 -- collar for the receiver (#3)
- 6 -- alignment mechanism
- 7 -- docking flange
- 8 -- guidance cone
- 9 -- probe motor
- 10 -- universal joint
- 11 -- housing for the docking probe
- 12 -- damping cylinder
- 13 -- connecting plug for the electrical system
- 14 -- electromechanical shock absorber

Below: Docking mechanism after docking is completed and hatch between the transport ship and the orbital station is opened:

- 1 -- locking bolt
- 2 -- seal
- 3 -- swivel arm for pivoting the guidance cone
- 4 -- docking flange
- 5 -- connecting plug for the hydraulic system
- 6 -- connecting plug for the electrical system
- 7, 8 -- docking latches [5]

"SOYUZ-31" RESEARCH PROGRAM OUTLINED

Moscow IZVESTIYA in Russian 30 Aug 78 p 4

[Article by B. Konovalov: "'Berolina' and Others"]

[Excerpts] Therefore, on 28 August they got up at 1200 hours. But nevertheless on the night before at 0100 hours they had succeeded in initiating the program of joint scientific research prepared by specialists of the GDR and USSR. In the "Vkladysh" instrument, created in the GDR, on "Soyuz-31" the international crew delivered on board the orbital complex a preserved culture of animal tissue stored at a temperature of 4° Celsius in a transport thermostat. Aboard the "Salyut-6" the cosmonauts transferred the "Vkladysh" into the on-board thermostat, set the temperature at 37° and gave nourishment to the "dozing" tissue. Over the course of five days it will develop under these conditions and then the vital activity of the cells will cease. Then, by comparing the flight samples with the controls, which will be kept under these same conditions, but on the earth, specialists will attempt to

clarify what changes arise at the cell and tissue levels of living matter when they enter space and begin to adapt to weightlessness conditions.

"Tissue culture" is one of the four joint biological experiments which the international crew began to carry out aboard the space complex. On the first working day they also began the joint experiments "Bacterial Growth," "Joining of Microorganisms" and "Metabolism of Bacteria."

Microorganisms are attractive objects for researchers because during flight time it is possible to obtain many generations of cells and thereby simulate the events which will transpire with complex organisms during far longer flights. These are singular "accelerated tests" of the effect of spaceflight conditions on the human organism as well, on those fundamental processes which transpire in cells. By comparing the flight data with the control data, scientists are studying what changes are taking place there in orbit. It is necessary to clarify precisely whether there is a change in the vital activity of microorganisms, metabolism, growth, development of intracellular structures. These experiments are of fundamental scientific importance and of more than a little practical importance. Indeed, for example, the problem of the optimum flight duration, an answer to which is also being sought in such experiments, is also to a certain degree the problem of its economy. In addition, in the future very simple microorganisms must be used in closed bioengineering life support systems which will supply people with oxygen, absorb carbon dioxide and purify water. Then there will be less need for sending "freighters" into orbit.

As on every flight, there will be on-board tests on the bodies of the cosmonauts as well, whose condition the physicians must watch carefully. During the period of active adaptation to weightlessness conditions aboard the "Salyut-6" there was an examination of the cardiovascular system of the space "novices."

"On the new international flight the cosmonauts have seemingly taken over from their predecessors in carrying out joint technological experiments. After the 'Morava' and 'Sirena' experiments, aboard the 'Salyut-6' they began the technological experiment 'Berolina,' prepared jointly with specialists of the GDR and USSR. In the Soviet 'Splav' and 'Kristall' apparatus, delivered to the station by the 'Progress' freighters, the international crew will carry out four individual experiments of an exploratory nature. A space technology is now developing before our eyes; in the future it will be extremely important for all of humanity. But for the time being it is necessary to select the materials most promising for production in orbit, to determine the most advantageous technological processes. This is the purpose of the 'Berolina' experiment, as it was for the preceding joint technological experiments of the socialist countries."

In the "Berolina" experiment, using different technological procedures, specialists will cultivate semiconductor monocrystals and carry out the melting and then the crystallization of glass with a complex composition.

Now the development of modern optical instruments frequently is dependent on the creation of glass with unusual properties, and this in turn requires its ever-greater complexity of composition. But under terrestrial gravitational conditions it is difficult to achieve a uniform distribution of "additives" for giving the necessary qualities to the glass. Specialists are hoping that in a state of weightlessness it will be possible to solve this problem successfully. And the broad search for conditions for optimum on-board cultivation of crystals, necessary for modern electronics, will possibly open the way to the creation of real workshops and factories in orbit.

Any flight in space involves not only the implementation of experiments earlier planned and prepared on the earth, but every time also a "journey into the unknown." There is always the probability of encountering a new, unexpected phenomenon. On the day of the launching of Bykovskiy and Jaehn Kovalenok and Ivanchenkov in the region of the Falkland Islands, situated not far from Antarctica, discovered an unusual cluster of clouds of a brownish-yellow color such as no one had previously observed. They shared the joy of their discovery with their comrades when they came aboard and all four are now watching for this concentration of clouds unusual in form and color.

The first working day of the international crew passed very vigorously. They started seven joint experiments. There was a good tempo from the start.

[543]

Abstracts of Scientific Articles

EARTH SURFACE AND METEOROLOGICAL OBSERVATIONS FROM OUTER SPACE

Budapest GEODEZIA ES KARTOGRAFIA in Hungarian Vol 30, No 3, 1978 pp 157-158

[Article by Dr Gabor Soos]

[Abstract] This article is the text of the author's opening address delivered on 2 March 1978 at the scientific conference of the Central Astronautics Section of the Organization of Technical and Natural Science Associations. The Ministry of Agriculture and Food has great expectations from the activities of the Central Astronautics Section. Specifically, it expects that, partly as a result of Hungary's increased participation in the Interkosmos Program, the following remote sensing applications will be implemented: land use and mapping (both cultivated and fallow lands, crop structure, soil types and distribution); crop estimation (various crops, yield forecasts); plant protection (early detection and prediction of pest damage and deficiency diseases); forestry operations (surveying of forests, reserve estimation, observation of damage); environmental protection (detection and forecasting of harmful emissions and their effects); water management (determination of soil moisture, flood warning, stream monitoring); cartography (making the existing maps more accurate, monitoring changes); and meteorology (weather forecasting, warning of hailstorms and thunderstorms). Monitoring and adaptation of foreign achievements in these and other areas is important; the Ministry has established a separate section for this purpose.

[479]

EFFECT OF INDUCED O₂ ABSORPTION BAND ON TRANSFORMATION OF RADIATION

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 14, No 6, 1978 pp 614-619

[Article by Yu. M. Timofeyev and M. V. Tonkov, Leningrad State University,
"Effect of Induced O₂ Absorption Band on Transformation of Radiation in the
Region 6 μm in the Earth's Atmosphere"]

[Abstract] The data presented here convincingly demonstrate that in computations of atmospheric transparency and outgoing thermal radiation it is necessary to take into account not only H₂O vapor absorption, but also induced O₂ absorption, to a considerable degree determining the transformation of radiation for altitudes $h_0 \geq 10$ km for all the considered atmospheric models. In particular, failure to take it into account can lead to an understating of outgoing thermal radiation up to 100% or more for $h_0 \approx 10-15$ km. Naturally, the neglecting of absorption in the induced O₂ band will lead to a considerable exaggeration of the moisture content of the upper layers of the atmosphere in the interpretation of satellite measurements of transparency and outgoing thermal radiation in the region of the H₂O vapor absorption band at 6.3 μm . The data given here relate to the spectral intervals 10 cm⁻¹. It is entirely obvious that for the case of transport of IR radiation in very narrow spectral intervals (for example, laser radiation) the contribution of oxygen absorption can be still more significant if these intervals are situated between the absorption lines of H₂O vapor and other gas components. This is particularly true for paths in the upper layers of the atmosphere where the absorption lines are very narrow. The principal conclusion of the study is that it is necessary to take induced O₂ absorption into account in the earlier developed methods for computing atmospheric transparency and also in the interpretation of transparency and thermal radiation measurements in the water vapor band 6.3 μm when making indirect determinations of the characteristics of atmospheric moisture content.

[512]

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